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Portland Cement Stucco



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PORTLAND CEMENT ASSOCIATION

PORTLAND CEMENT STUCCO

PORTLAND cement stucco is a material on which architects and homebuilders easily agree. Its attractive appearance, durability and its adaptability to individual treatment, make it the preferred material for the expression and preservation of the builder's architectural ideals. Portland cement stucco is reasonable in cost, and renders splendid protection against fire and weather.

Evidence of the preference accorded stucco by builders in all ages, has come to us from the historic past. The Greeks, Romans and Egyptians used stucco in a number of famous buildings which have been universally recognized as architectural masterpieces. Today, stucco made of the modern portland cement is stronger and more durable, and when built in accordance with the recommendations contained in this booklet, will give pleasing and satisfactory results.

Excellent examples of the use of portland cement stucco abound in both the extreme cold and warm climates. The same is true in the extremes of moist and dry atmospheric conditions. The recognition accorded portland cement stucco by the architectural and engineering professions commends it to the builder as a safe and satisfactory material for general use.

In addition to the purely structural and practical adaptation of portland cement stucco, it affords the architect an unlimited opportunity to carry out color composition. Colors of any desired tint or shade may be obtained by the use of mineral coloring pigments, and by the use of special, colored aggregate a great variety of color and shadow effects may be had.

Portland cement stucco is easily cleaned or freshened and requires no painting, thus reducing maintenance and preserving the original appearance of the building.

What Stucco Is

Portland cement stucco consists of a mixture of portland cement, sand, hydrated lime and a sufficient amount of water to produce a workable mix, applied to a suitable surface and permitted to harden. Successful use of stucco depends in a large measure upon the structure to which it is applied. The surface to be stuccoed should be free from loose parts and be rigidly and firmly supported. Drawings on pages 14

and 15 show typical details of standard stucco construction.

Recommendations For Making and Using Stucco

Cement—Cement for stucco should meet the requirements of the Standard Specifications for Portland Cement of the American Society for Testing Materials.

Fine Aggregate Fine aggregate should consist of sand or screenings from crushed stone or crushed pebbles, free from dust, loam, vegetable and other foreign matter. It should be graded from fine to coarse and its largest particles should pass a No. 8 screen.

Water—Water should be clean, free from acid, oil, alkali and vegetable matter.

Hydrated Lime Hydrated lime should meet the requirements of the Standard Specifications for Hydrated Lime of the American Society for Testing Materials. When used it should be carefully measured and added to the sand and cement dry. The amount of hydrated lime in no case should be more than one-fifth the volume of portland cement.

Color—Permanent mineral colors only should be used in stucco work. These colors should be fully guaranteed by their manufacturer to be unaffected by lime, cement, or weather. The amount of coloring used should not be more than 10 per cent of the weight of the portland cement. The coloring matter and fine aggregate should be mixed together first and then the cement added. The whole should then be mixed dry by shoveling from one pile to another through a one-quarter inch wire screen until the entire pile is uniform in color. Water should then be added to bring the mortar to a proper plastering consistency. (See table on page 5.)

Hair or Fiber Hair or fibre should be used in the scratch coat only when stucco is applied over wire lath that is to be back plastered or on metal or wire lath applied over sheathing and is separated therefrom by furring deeper than $\frac{3}{8}$ -inch.

Proportions The mortar for all coats should be mixed in the proportion of one part by volume of portland cement, to three parts of fine aggregate. A sack of portland cement is considered as one cubic foot. The exact proportions of materials for the mortar including water, must be uniformly maintained throughout the entire job.

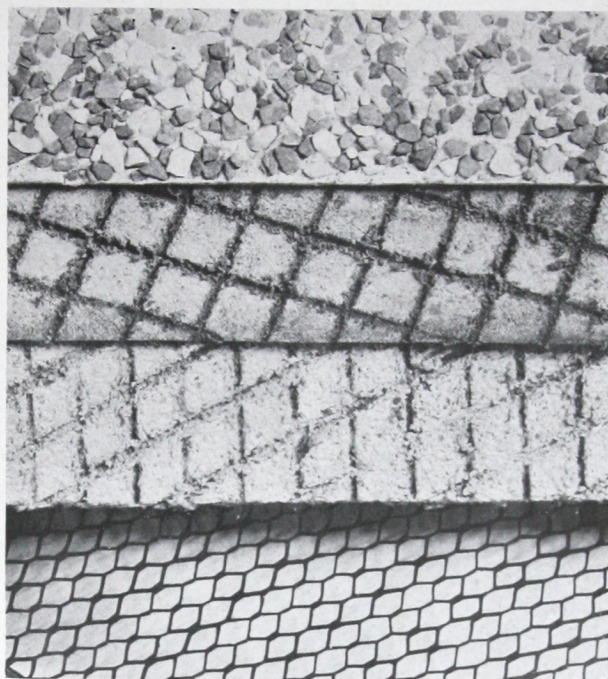
Mixing—Mortar can be mixed best in a mortar mixing machine. The period of machine mixing should not be less than five minutes after all materials, including water, are in the mixer. When hand mixing is necessary it should be done in a watertight mortar box and the materials mixed dry until the entire mass is uniform in color. Water is then added and the mixing continued until the consistency is uniform throughout. Use only enough water to produce a workable mix. The less water used within working limits, the better the quality of the mortar. Mortar which has begun to stiffen or take on initial set should not be used. Mix only the amount of mortar that would be used within thirty minutes.

Procedure—The plastering operation is to be carried on in one general direction without permitting the mortar to dry at the edges. If impossible to finish a full wall at one time, the joints should be made at some natural division of the surface, such as a pilaster, door or window.

First Coat The first, or "scratch", coat should have an average thickness of $\frac{1}{4}$ -inch over the lath, or base. It should be well trowelled into the lath, or base, to obtain a thorough bond, or key. This coat should then be heavily cross-hatched to provide a strong mechanical key for the next coat.

Second Coat The second, or "brown", coat should be applied the day following the placing of the first. The first coat should be dampened, but not saturated, before the application of the second coat. The second coat should be from $\frac{3}{8}$ to $\frac{1}{2}$ -inch thick, and should be brought to a true, even surface by frequent testing with a straight edge. When stiff enough, it should be floated with a wooden float and lightly and evenly cross-hatched to secure a good mechanical bond for the finish coat. The surface should then be sprayed and wetted and kept from drying out for at least three days.

Two-Coat Work Whenever two-coat work is required, the first coat should preferably be "doubled"—that is, as soon as the first coat is stiff enough, it should be followed by a second application of mortar, and this should then be treated as described under "Second Coat."



Successive steps in the application of three-course stucco on metal lath. The heavy cross hatched scoring of the two base courses provides excellent bond for the succeeding course and for the pebble-dash finish.

Back-Plastered Work In back-plastered work, the backing coat is preferably applied directly following the completion of the brown or second coat. The keys of the scratch coat should be thoroughly wetted and the backing coat immediately applied to a thickness of $\frac{5}{8}$ to $\frac{3}{4}$ -inch and should be finished $\frac{1}{4}$ -inch back of face of studs.

Finish Coat The finish coat should not be applied until at least one week after the application of the second coat. All finishes described on page 4 require that the finish coat should be brought to a smooth, even surface with as little rubbing as possible before the addition of materials for finish surface. The sand for the finish surface should be well graded from fine to coarse.

Curing—The curing of all under-coats by sprinkling and the protection of the finish coat against sun, wind, rain or frost by the use of tarpaulins is always to be recommended. All coats should be permitted to dry out very slowly, retaining their original water content as long as possible.

Freezing—Stucco should not be applied when the atmospheric temperature is below 32 degrees F. If necessary to complete a small portion of the job in cold weather, canvas should be used to protect the newly placed stucco from freezing.

Finish

Stippled Finish A stippled finish is obtained by lightly patting the finishing coat with a brush of broom-straw to give an even, stippled surface.

Rough Cast or Spatter Dash A mixture of one sack of cement to 3 cubic feet of fine aggregate is thrown forcibly against the newly placed finishing surface to produce a rough, uniform texture when viewed from a distance of 20 feet. Special care should be taken to prevent rapid drying out of this finish by thorough wetting down at intervals after the stucco has hardened sufficiently to prevent injury. A variety of spatter dash finish can be secured by using colored aggregate.

Pebble Dash Before the finishing coat has begun to harden, clean, round pebbles or other material as selected, not smaller than $\frac{1}{4}$ -inch or larger than $\frac{3}{4}$ -inch, previously wetted, are thrown forcibly against the wall so as to embed themselves in the fresh mortar. They should be distributed uniformly over the surface of the final coat and pushed back into the mortar with a clean wood float. No rubbing should be done after the pebbles are embedded.

Exposed Aggregate The finishing coat is composed of an approved, selected coarse sand, crushed marble or granite or other special material, in the proportion given for finishing coats. Within 24 hours after being applied and troweled to an even surface, it is scrubbed with a stiff brush and water. If the stucco is too hard, a solution of one part hydrochloric acid in four parts of water by volume can be used. After the scrubbing, all traces of the acid should be removed by thorough spraying with water from a hose.

Sand Floated A sand floated finish is obtained by rubbing the finishing coat with a circular motion of a wood float, a little sand being added to slightly roughen the surface. This floating should be done when the mortar has partly hardened.

Sand Sprayed A sand sprayed finish is obtained by spraying on with as much force as possible, by means of a long fibre brush or whisk broom, a creamy mixture of equal parts of cement and sand, mixed fresh at least every 30 minutes and kept well stirred until used. This treatment should be applied before the finishing coat has attained its early hardening, that is, within three to five hours. The addition of hydrated lime not to exceed 10 per cent of the weight of the cement in the mixture, will produce lighter shades of finish.

Smooth Finish The finish coat should contain all the material desired in the finished surface. The troweling of the finish coat should be continued until the desired smoothness and texture is obtained, but should be the least possible to produce this surface finish. Particular attention to proper curing methods is absolutely necessary to obtain the best results with this type of finish.

Sponge Finish Immediately after the finishing coat has been brought to an even surface, a clean, soft pine float is pressed down onto the surface and withdrawn, care being taken not to separate the surface coat from the undercoat.

Construction Details

An overhanging roof or similar projection is recommended to keep water away from the stucco and prevent dirt marks. Horizontal surfaces exposed to water should be avoided. All exposed stucco surfaces should shed water quickly. Suitable flashing should be provided wherever projecting wood trim occurs and should be continuous on wall copings, corners, rails, etc. Positive means should be provided to keep water from getting behind the stucco. Down-spout hangers, gutters and other fixed supports should be in place before applying the stucco. Sketches of typical construction details are shown on Pages 14 and 15.

Masonry Walls All masonry walls should be thoroughly cleaned free from dust, dirt and loose particles and wetted to such a degree that water will not be absorbed from the stucco.

Concrete Walls Monolithic concrete walls should preferably be rough and of coarse texture rather than smooth, for the application of stucco. Such walls may be roughened by picking, hammering with a pneumatic hammer or by an acid wash treatment.

Concrete Block and Concrete Tile Walls The surface of concrete block to be stuccoed should be rough with coarse texture to increase the bond of the stucco, but the block should be of good quality. Mortar joints should be raked out or cut back at least even with the surface.

Brick Walls Surface brick to be stuccoed should be rough, hard-burned and of good quality. Mortar joints should be not less than $\frac{3}{8}$ -inch thick, and the mortar should be raked out for at least $\frac{1}{2}$ -inch from the face.

Clay Tile should be hard-burned with heavy
Tile scoring and should be set with exterior faces
Walls in line. Joints should not be raked out but mortar should be cut back to surface.

Frame Stucco on sheathed frame construction is
Walls not intended to add greatly to the rigidity of the building. Diagonal bracing should be used at corners of walls and the details of the frame work given attention to reduce the vibration in the structure to a minimum. Bridging should always be used for the back-plastered type for which sheathing is omitted.

Sheathing should be horizontal and not diagonal. It should be firmly nailed to the studs and covered with a good quality tar or asphalt paper with plenty of lap between sheets and at baseboard and flashing. Furring should be $\frac{3}{8}$ -inch crimped and should be fastened over the sheathing paper directly along the lines of studs with $1\frac{1}{4}$ -inch staples 12 inches apart. Furring should be placed entirely around all openings and around curved surfaces.

Where metal furring for back-plastered construction is used it should be stapled to studs at intervals not greater than 12 inches with $1\frac{1}{4}$ -inch by 14 gauge staples. Self-furring lath should be rigidly fastened to the studs with staples.

Metal lath should be galvanized or painted expanded metal weighing not less than 3.4 pounds per square yard, or galvanized or painted woven wire not lighter than 19-gauge, $2\frac{1}{2}$ meshes to the inch and stiffeners at 8-inch intervals.

Vertical laps of metal lath should be at supports and fastened with staples 4 inches apart. Horizontal joints should be locked or butted or tightly laced with 18-gauge galvanized wire. Sheets of metal lath should be folded around the corners and firmly stapled down. Corner beads should not be used.

Additional insulation may be given to back-plastered walls by fastening felt fibre or cork insulating sheets to the studs between the back-plaster coat and the interior finish. A heavy grade of good building paper may be used for this purpose but should be so placed as to leave an air space between it and the stucco.

Old frame structures to be stuccoed should be made strictly sound and rigid before applying the stucco.

Notes on Coloring Pigments

Depth of the shade produced by mineral colors can be secured only by mixing the materials for a longer time than would be required in work in which color is not used. Magnesium fluosilicate has also been used with apparent effectiveness in setting the color in the stucco.

Red oxides of iron produce the most durable red tints. Venetian red should be avoided, as it tends to run and fade. Manganese oxide is probably the best material for black, although a high grade of carbon black or lampblack is generally satisfactory. Common lamp black should not be used.

Table of Colors to Be Used in Portland Cement Stucco

COLOR DESIRED	COMMERCIAL NAMES OF COLORS FOR USE IN CEMENT	Pounds of Color Required for Each Bag of Cement to Secure	
		Light Shade	Medium Shade
Grays, blue-black and black.....	{ Germantown lampblack*.....	$\frac{1}{2}$	1
	{ Carbon black.....	$\frac{1}{2}$	1
	{ Black Oxide of manganese.....	1	2
Blue shade.....	Ultramarine blue.....	5	9
Brownish-red to dull brick red.....	Red oxide of iron.....	5	9
Bright red to vermilion.....	Mineral turkey red.....	5	9
Red sandstone to purplish-red.....	Indian Red.....	5	9
Brown to reddish-brown.....	Metallic brown (oxide).....	5	9
Buff, colonial tint and yellow.....	{ Yellow ochre**.....	5	9
	{ Yellow oxide.....		
Green shade.....	{ Chromium oxide.....	5	9
	{ Greenish blue ultramarine.....	6	-

*Only first quality lampblack should be used. Carbon black is light and requires very thorough mixing. Black oxide or mineral black is probably most advantageous for general use. For black use 11 pounds of oxide for each bag of cement.

**Should contain not less than 15 per cent of the oxide

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SMOOTH OR TROWELLED FINISH

Portland cement stucco may be trowelled to a smooth, even surface similar in appearance to interior plaster finish, but having weather resisting qualities. This finish is easiest of all to clean by scrubbing. Coloring matter may be included in the mortar finishing coat to give any desired tint or shade.



SAND FLOATED FINISH

The sand floated finish produces a rougher texture than the smooth trowelled finish. Colored sand and coloring material with the cement can be used to produce a great variety of color effects. This finish is easy to obtain. The grained surface prevents monotony and produces minute shadows with mellow color tones.

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SPATTER DASH FINISH

The spatter dash finish is most frequently used and produces a rough and attractive texture. Colored aggregate and coloring material in the cement may be used with pleasing effect. Best results with spatter dash are obtained by experienced workmen, but the prevalence of satisfactory examples of this finish shows that experienced workmen may be found in all parts of the country.



STIPPLED FINISH

Stippling produces a rough though uniform texture, increasing the shadow effects over a sand floated finish. With portland cement stucco this finish is easy to obtain and is very popular. The degree of roughness of the texture can be governed by the workman and by the use of coloring matter. A great variety of color effects can be obtained with this finish.

PORTLAND CEMENT STUCCO



SPONGE FINISH

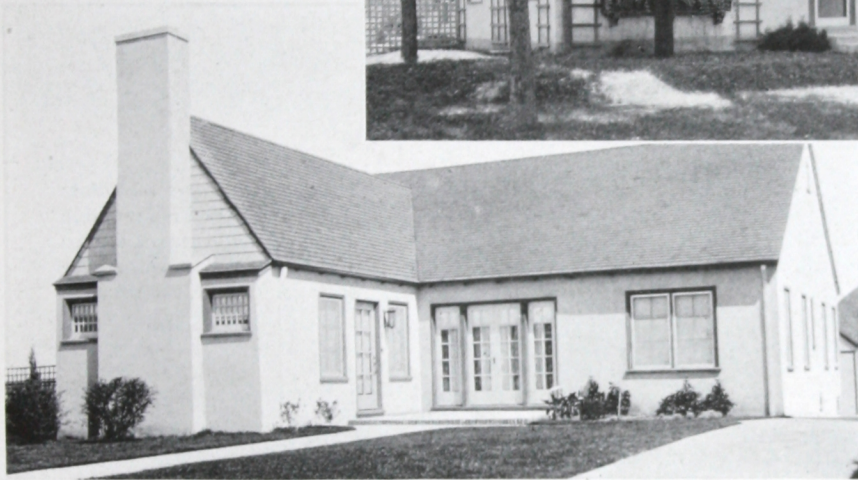
This finish, produced by carefully working the plastic stucco with a soft wood float, well illustrates the variety of surface treatments possible with portland cement stucco. A clever workman can develop striking and unusual finishes which will harmonize with almost any architectural scheme or surrounding.



PEBBLE DASH

The many different effects in color and appearance of the pebble dash finish are limited only by the variety of the aggregate available and the skill of the workman. The photograph shows only in part the contrast that may be obtained with pebbles of different color, size and shape.

The usual depreciation of the house due to the effects of weather and climate is eliminated when the house is covered with portland cement stucco. Rapid changes in temperature, arid heat, rains, moisture, sunshine and frost have no effect on properly applied stucco.



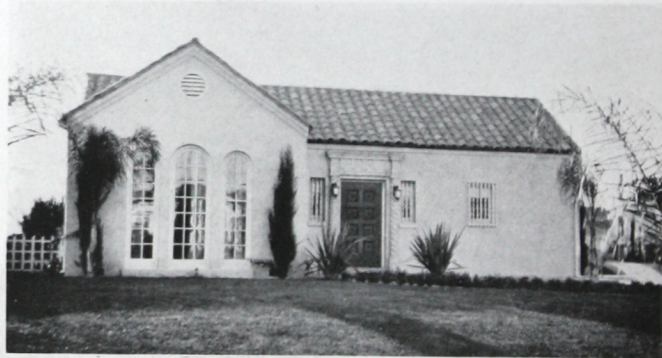
Climbing vines on lattice work do not injure the house covered with a coat of stucco. Stucco is not subject to decay, and foliage and dampness from vines or bushes leave the surface uninjured.





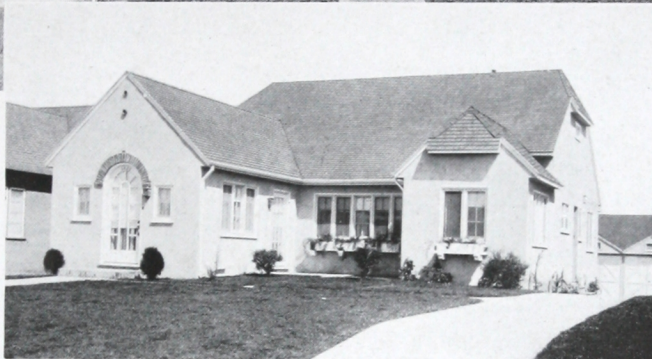
The wide variety of colors and surface textures possible with portland cement stucco make it easily adaptable to any style of architecture.

For the small home or for the elegant mansion, portland cement is equally desirable. Its freedom from deterioration makes it economical and desirable for any house.





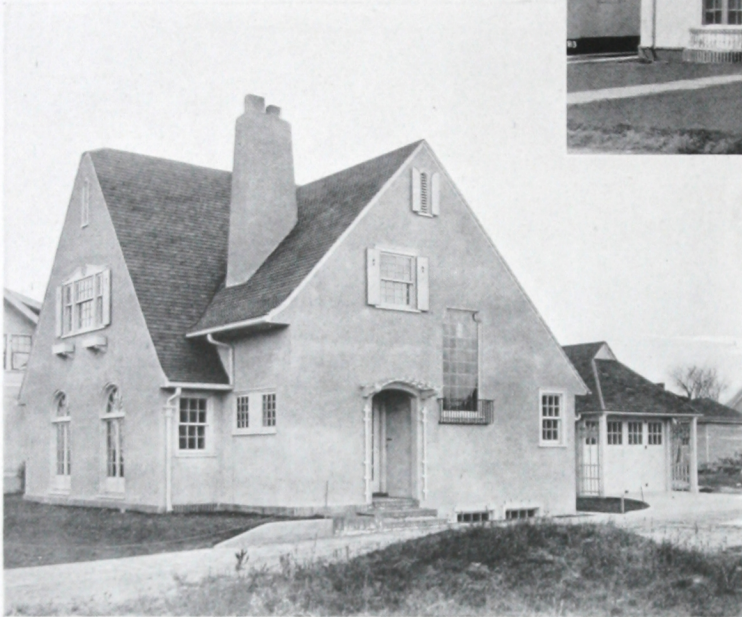
Fire protection is an important consideration in building the home. Portland cement stucco makes an effective barrier against exposure fires such as occur in residence districts.



Whether new buildings or old are covered with portland cement stucco the comfort of their living qualities is certain to be increased, as well as their beauty and economy of upkeep.



Periodical painting is not required for the stucco covered house. Dirt streaks are easily removed by scrubbing. The appearance of a stucco coat can easily be changed by the use of an inexpensive cement paint or by the application of a thin coat of new stucco on the old surface.



Old houses may be artistically rejuvenated and their appearance completely changed by the use of portland cement stucco. Where the structural parts of the house are sound the home may thus be given a new lease of life with an added, permanent beauty.

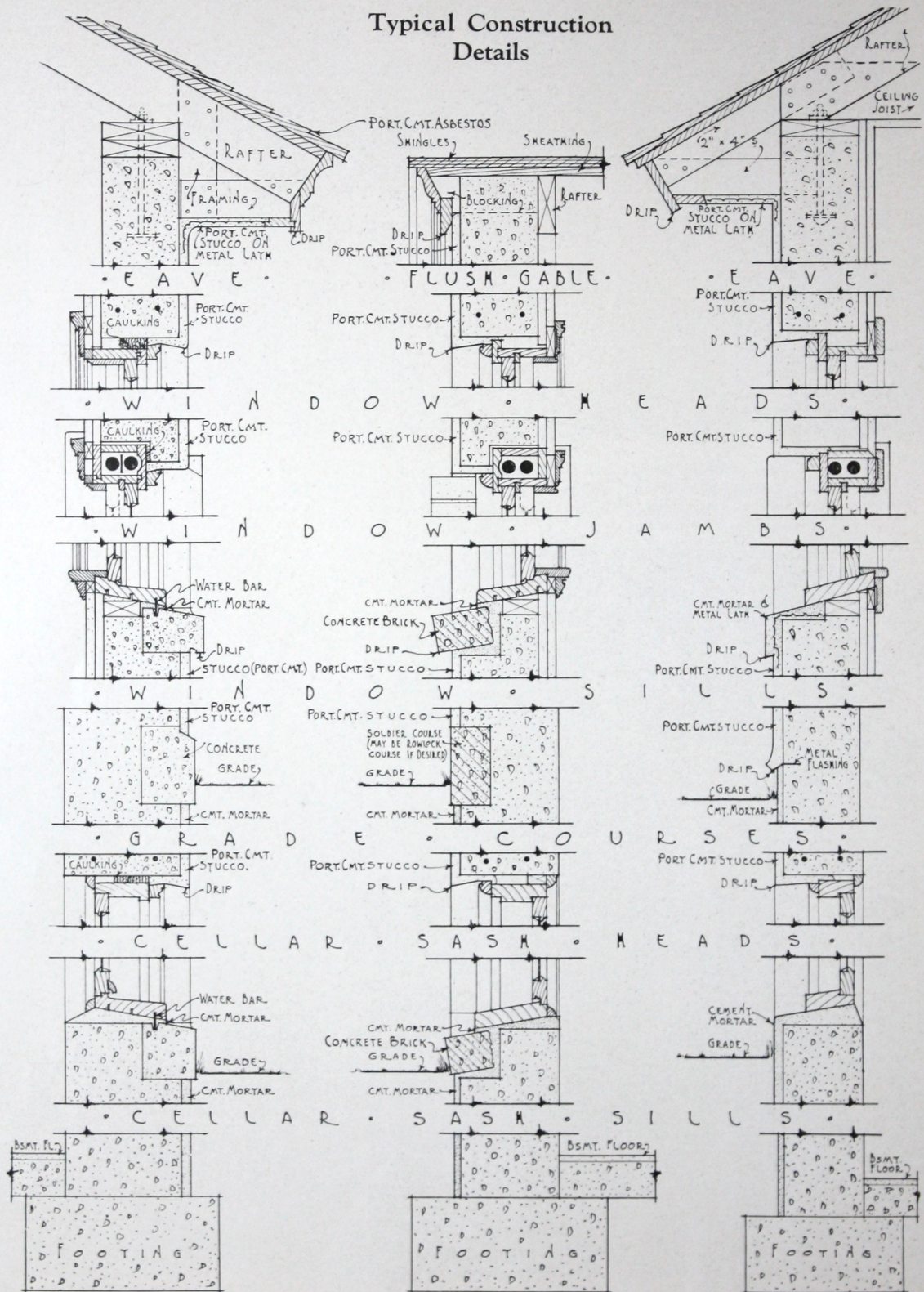




The attractive stucco surface of the beautiful residence above is in keeping with the simple but elegant details of the design, while the surface finish of the homey cottage below helps convey an atmosphere of comfort.



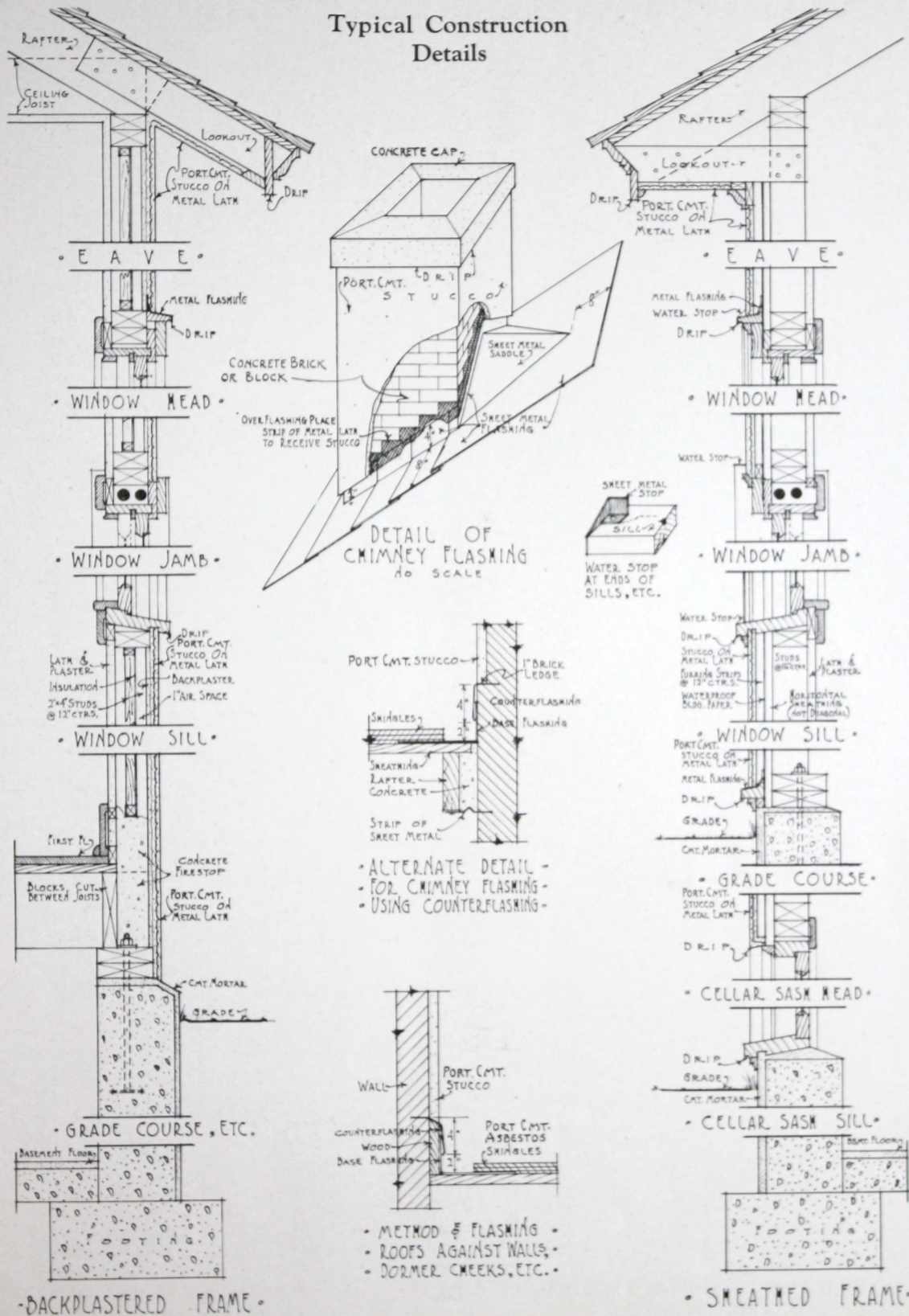
Typical Construction Details



CONCRETE SILLS, ETC. •

CONCRETE BRICK SILLS, ETC. • SELF-FORMED SILLS, ETC.

Typical Construction Details



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